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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/388,989	09/02/1999	BARNEY M. COHEN	AMAT/3191.03	4766

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EXAMINER

PADGETT, MARIANNE L

ART UNIT PAPER NUMBER

1762

DATE MAILED: 03/12/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/388,984

Applicant(s)

Cohen et al

Examiner

M.L. Palguta

Group Art Unit

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—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- ☒ Responsive to communication(s) filed on 8/27/01
- ☒ This action is **FINAL**.
- ☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- ☒ Claim(s) 1, 3-4, 6, 8-14, 17-33 is/are pending in the application.
- Of the above claim(s) _____ is/are withdrawn from consideration.
- ☐ Claim(s) _____ is/are allowed.
- ☒ Claim(s) 1, 3-4, 6, 8-14 & 17-33 is/are rejected.
- ☐ Claim(s) _____ is/are objected to.
- ☐ Claim(s) _____ are subject to restriction or election requirement

Application Papers

- ☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.
- ☐ The drawing(s) filed on _____ is/are objected to by the Examiner
- ☐ The specification is objected to by the Examiner.
- ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

- ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).
- ☐ All ☐ Some* ☐ None of the:
- ☐ Certified copies of the priority documents have been received.
- ☐ Certified copies of the priority documents have been received in Application No. _____
- ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____

Attachment(s)

- ☒ Information Disclosure Statement(s), PTO-1449, Paper N (s) _____
- ☐ Interview Summary, PTO-413
- ☐ Notice of Reference(s) Cited, PTO-892
- ☐ Notice of Informal Patent Application, PTO-152
- ☐ Notice of Draftsperson's Patent Drawing Review, PTO-948
- ☐ Other _____

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1. Claims 29-30 are objected to or rejected under 35 U.S.C. 112, ^{2nd} first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The phrases "more than about" and "less than about" are objected to as contradictory, because a value that is "about" can be either greater than or less than the claimed value, thus contradicting the other required limitation. Alternative language would remove this problem.

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 3-4, 6, 8-14, and 17-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoo et al, in view of Zhao et al.

After patterning a dielectric layer, Yoo et al teach two plasma etching steps (which can be considered to include cleaning), before metalizing, where a Ti/TiW (barrier) layer may be deposited before the Al. First an Ar plasma etch (1 or 2 minutes) with exemplified RF power of 400W is employed, which smoothes sharp corners on the patterned dielectric layer. There may then follow a reactive ion etch of less than about 60 sec., where He plus a reactive gas, exemplified by CF₄ or CF₃H, then removes

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material at the bottom of the contact openings. Yoo et al differ from the claims by not teaching H_2 as their reactive gas, and not giving all the parameters for their plasmas. While Yoo et al does not discuss aspect ratios *per se*, they do teach that the feature sizes etched in the integrated circuit structure are about $1\mu m$ or less (abstract), and teach various dielectric layer thickness from 1000 \AA to $10,000\text{ \AA}$ (col. 3, lines 63; col. 4, line 18), with the example making contact openings of $0.7\text{ }\mu m$ in a dielectric layer of $7500\text{ \AA} + 1000\text{ \AA} = 8500\text{ \AA}$, thus effectively teaching aspect ratios as claimed due to these dimensions.

Zhao et al teach an Ar plus H_2 plasma using ratios of H_2 to Ar flow rates that maybe 1:20 to 100:1, RF powers of 20-400 W with 250 watts preferred, and D.C. bias on substrate, that will clean, i.e. etch, the bottoms and side walls at the bottoms of high aspect ratio vias, hence it would have been obvious to one of ordinary skill in the art the H_2 was a relative gas that could have been used equivalently in the process of Yoo et al, in their second plasma step, that uses He + reactive gas, because it was shown to produce like effects in analogous situations and configurations (i.e. high aspect ratio plasma treatments). Power parameters of Zhao et al would have been expected to be applicable to the second plasma of Yoo et al for these alternative gases, and while D.C. bias is discussed in Zhao et al, the examiner takes notice that D.C. and R.F. voltages of like absolute values may generally be applied equivalently for acceleration of ions.

Applicant now claims the watts used to produce the bias, which is not comparable to the number of volts, however it is noted that for the first plasma of Yoo et al, Ar^+ is desired to be used for sputtered etching, which is generally known to be most efficiently

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performed using bias. While unlike Zhao et al who combine the sputter etch and active etch, Yoo et al does the "soft" reactive etching second, where the reactive gas as discussed in both references will react with what is at the bottom of the via, and remove redeposited material on sidewalls (Zhao), hence as this is descriptive of an isotropic type process, no bias would have been desirable than in the first, Ar plasma, since it is desirable to etch in more directions than down. Overall power input would obviously need to be maintained in order to maintain the plasma.

4. The patents to Webb, Brar et al, Agustino et al, Phillips, Myers and Polak are of interest for teaching various plasma cleaning techniques intended to be applied to dielectric materials, before metal is deposited thereon.

5. Applicant's arguments filed August 27, 2001 and discussed above have been fully considered but they are not persuasive. Note that the clarification of claim language enabled claims 12, 18, and 20 to be included in the art rejection.

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

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extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication should be directed to M. L. Padgett on M-F from about 8 am to 4:30 pm at telephone number (703) 308-2336; or FAX # (703) 872-9311 (official) and 305-6078 (unofficial).

M.L. Padgett/dh

March 5, 2002

March 7, 2002



MARIANNE PADGETT
PRIMARY EXAMINER
GROUP 1700